PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2000-176956

(43)Date of publication of application : 27.06.2000

(51)Int.Cl. B29C 44/00
// B29C 31/04
B29K105:04

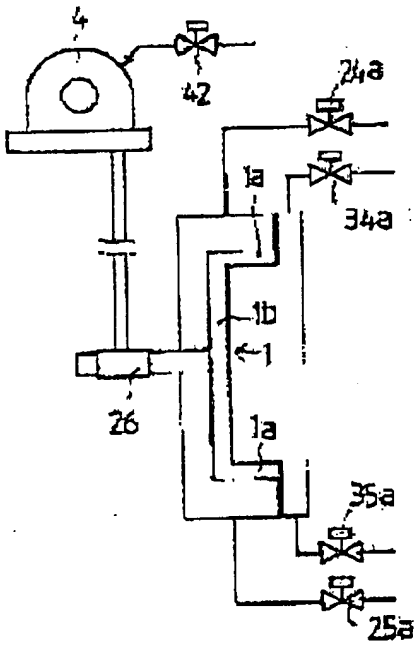
(21)Application number : 10-361056

(22)Date of filing : 18.12.1998

(71)Applicant : DAISEN KOGYO:KK

(72)Inventor : NOHARA IWAO
NAKAJIMA TOMIO
IDA KIYOTAKA

(54) FILLING METHOD OF RAW MATERIAL BEAD



(57)Abstract:
PROBLEM TO BE SOLVED: To obtain a foamed molded object to which strength difference is partially set by changing the packing density of raw material beads at the desired area in a cavity.
SOLUTION: In a pressurizing compression packing method for packing a cavity 1 with raw material beads from a raw material service tank 4 by providing the pressure difference between the raw material service tank 4 and the cavity 1, the pressure control value in the cavity 1 is changed during packing operation and the supply of raw material beads is once stopped at a time of pressure fluctuations to supply compressed air and the packed raw material beads are pressed to one side of the cavity 1 to resume packing to perform control so as to provide difference in the packing density of raw material beads between the side surface part 1a provided at the position separated from the feeder 26 in the cavity 1 and the plane part 1b provided at the position near to the feeder 26.

CLAIMS

[Claim(s)]
[Claim 1] In the foaming approach released from mold and taken out after filling up with a raw material bead the cavity for foaming surrounded and formed in the rear-face side with the metal mold of the pair which arranged the chamber, heating it, making it foam and cooling a foaming object, nothing, and it While facing preparing differential pressure between a raw material service tank and said cavity, and being filled up with a raw material bead and fluctuating the pressure-control value in said cavity gradually during the restoration actuation After suspending supply of a raw material bead on the occasion of the pressure fluctuation, supplying compression air and pressing a filled up raw material bead to one cavity side, supply of a raw material bead is resumed. The restoration approach of the raw material bead characterized by controlling to prepare a difference in the pack density of a raw material bead by the part in said cavity.
[Claim 2] The restoration approach of the raw material bead according to claim 1 which introduces heating steam and carries out temporary immobilization of the filled up raw material bead before resumption of raw material bead supply press of the filled up raw material bead by said compression air, or after pressing.
[Claim 3] The restoration approach of a raw material bead according to claim 1 or 2 of fluctuating the pressure-control value in said cavity while exhausting the air for restoration using the path between molds formed so that it may be outside open for free passage to the joint of metal mold located around a cavity, when mold closure of the metal mold of said pair is carried out.
[Claim 4] The restoration approach of claim 1 controlled also about the differential pressure between a raw material service tank and said cavity with control of the pressure in said cavity, or a raw material bead given in 2 or 3.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to amelioration of the restoration approach of the raw material bead in the foaming approach for manufacturing the adiathermic container made of foaming resin, such as polystyrene, the mold material for construction, or heat insulation under floor ground material.
[0002]
[Description of the Prior Art] The outline of the foaming approach used as the background of this invention is explained. As shown in the cross-section schematic drawing of drawing 2, the convex type metal mold 31 and the concave metal mold 21 are fixed to frames 33 and 23, arrangement of the metal mold equipment used for this conventional foaming is mutually close, and opposite arrangement is carried out so that a foaming product may form the cavity 1 by which restoration shaping is carried out. and although the concave metal mold 21 is usually being fixed, the convex type metal mold 31 is arranged movable with the closing motion driving gear (not shown) which can carry out retreat migration rightward drawing 2 -- horizontally, can take out the fabricated foam from the condition which formed the cavity 1 in the concave metal mold 21 like drawing 2 , and can carry out advance migration leftward drawing 2 -- since it is shaping actuation. And many vent holes 22 and 32 are ****(ed) by this metal mold 21 and 31 over that whole surface so that the utility of the steam for heating etc. can be passed.
[0003] Moreover, the concave side chamber 2 to which the utility of steam etc. is supplied, and the convex side chamber 3 are formed in the rear-face side of these concaves and the

convex metal mold 21 and 31. In addition, in this example, the up utility openings 24 and 34 for supplying the steam for heating etc. are formed in the upper part of each chamber 2 and 3, the lower utility openings 25 and 35 are formed in the lower part, and it connects with a reduced pressure pump or drain piping (neither is illustrated).

[0004] In addition, in fact, the vent holes 22 and 32 of a large number ****(ed) by metal mold 21 and 31 insert in the front face of metal mold 21 and 31 the core vent made from an aluminium alloy which consists of a barrel which has a lid with an outer diameter of 7-12mm which ****(ed) 10-20 vent holes of 0.5mmphi extent in the core-vent mounting hole which carried out hole dawn arrangement in the pitch of 20-30mm, and are prepared.

[0005] Like the packer of the raw material bead which fills up with the foaming approach using such metal mold equipment for foaming the raw material bead which carried out mold closure of the (1) metal mold, formed the cavity 1, and carried out [polystyrene] pre-expansion into this cavity 1. (2) The heating process which heats this raw material bead with the steam for heating, and carries out melting foaming. (3) After that, after the cooling process which carries out cooling solidification of the foam, and (4) cooling, carry out die opening and it consists of a procedure of the mold release process taken out from metal mold equipment as a foaming object of a predetermined configuration.

[0006] Here, the packer of (1) raw-material bead degree is described further. Although it is the process fed and filled up with the raw material bead which pressurized the external raw material service tank 4 with compression air, and held it in the interior in a cavity 1 through a feeder 26 through a delivery pipe 41 and there are the cracking filling-up method, the pressurization filling-up method, the pressurization compression filling-up method, etc. in it, the compression air into which all were sent with a raw material bead is extracted by both-sides chambers 2 and 3 through vent holes 22 and 32 from a cavity 1, and is discharged outside.

[0007] And for example, while conveying in a cavity 1 by the differential pressure by the pressurization compression filling-up method, pressurizing a raw material bead, forming both the raw material service tank 4 and the cavity 1 for differential pressure, it is the approach with which it is filled up under a pressure predetermined [more than atmospheric pressure]. In this case, the pressure in a cavity is preparing and controlling the pressure control valve etc. in the process which it is extracted by the both-sides chambers 2 and 3 through vent holes 22 and 32 from a cavity 1, and is discharged outside.

[0008] According to this restoration approach, since filling pressure can be set up highly, a charging efficiency can also improve, and the advantage which can prevent the variation in pack density is acquired. That is, since compressibility becomes comparatively homogeneous by side-face partial 1a of a cavity 1, and flat-surface partial 1b and there is no unevenness in the restoration degree of the side-face partial 1a and flat-surface partial 1b in drawing 3 which shows packing formed from a cavity 1, it will be hard to produce foaming unevenness also at the time of pressurization foaming, and a homogeneous foaming object will be acquired. (In drawing 2 and drawing 3 , the common sign is given to the side-face part and the flat-surface part.)

[0009] Thus, it was what is considered so that the variation in quality like foaming unevenness as much as possible may not arise in mold goods in the conventional foaming. However, in a box-like container as shown in drawing 3 from the convenience on use, there is a case where he wants to fabricate side-face partial 1a which becomes a part for the wall to closing in from flat-surface partial 1b which is a bottom part, and to give high intensity. By the above mentioned usual pressurization compression filling-up method, there was a problem that it could not respond to such a request.

[0010] Moreover, a difference is prepared in foaming extent by the part of a foaming object, and there is the Normal cracking filling-up method as the restoration approach of giving change to completion reinforcement. Without closing concave and the convex metal mold 21 and 31 completely on the occasion of restoration actuation, a raw material bead is sent in from the raw material service tank 4 by the injection air sent into a feeder 26 in the condition which left a certain amount of clearance temporarily to those metal mold periphery sections 21a and 31a, i.e., the condition that established cracking and that cracking clearance was wide opened by atmospheric air, and it fills up with this cracking filling-up method in the atmospheric pressure condition.

[0011] By such cracking filling-up method, since the raw material bead of flat-surface partial 1b of a cavity 1 is mechanically compressed too much by the cracking clearance by eye mold closure after restoration, as compared with side-face partial 1a, pack density serves as size.

Consequently, high intensity is made to fabricate flat-surface partial 1b as compared with side-face partial 1a. Thus, although only flat-surface partial 1b could be fabricated by the cracking filling-up method to high intensity, when side-face partial 1a was not able to be fabricated to high intensity, and the part from which thickness differs was in flat-surface partial 1b, there was a problem that homogeneous pack density was not obtained all over flat-surface partial 1b.

[0012] As the other approaches, two sorts of raw material beads with which expansion ratio differs are prepared, and there is the approach of using properly in the first half and the second half of restoration actuation. According to this, expansion ratio can be changed by the part of a restoration Plastic solid, and the foaming object with which structure reinforcement differs as a result can be acquired. However, by this approach, there was an inconvenient point that expansion ratio naturally differed beforehand and that how many kinds of those raw material beads must be prepared.

[0013]

[Problem(s) to be Solved by the Invention] This invention is proposed that such a problem should be solved, the pack density of the raw material bead of the request part of the foaming object in a cavity is changed, and the restoration approach of the raw material bead in the foaming approach that the foaming object which therefore set up the difference on the strength partially can be acquired is offered.

[0014]

[Means for Solving the Problem] The restoration approach of the raw material bead of this invention which solved the above-mentioned problem In the foaming approach released from mold and taken out after filling up with a raw material bead the cavity for foaming surrounded and formed in the rear-face side with the metal mold of the pair which arranged the chamber, heating it, making it foam and cooling a foaming object, nothing, and it While facing preparing differential pressure between a raw material service tank and said cavity, and being filled up with a raw material bead and fluctuating the pressure-control value in said cavity gradually during the restoration actuation After suspending supply of a raw material bead on the occasion of the pressure fluctuation, supplying compression air and pressing a filled up raw material bead to one cavity side, supply of a raw material bead is resumed. It is characterized by controlling to prepare a difference in the pack density of a raw material bead by the part in said cavity.

[0015] Moreover, this invention can be preferably materialized in the following gestalt.

(1) The restoration approach of the raw material bead of a gestalt of performing actuation of introducing heating steam and carrying out temporary immobilization of the filled up raw material bead before resumption of raw material bead supply press of the filled up raw material bead by said compression air, or after pressing.

(2) The restoration approach of the raw material bead of a gestalt of fluctuating the pressure-control value in said cavity while exhausting the air for restoration using the path between molds formed so that it may be outside open for free passage to the joint of metal mold located around a cavity, when mold closure of the metal mold of said pair is carried out.

(3) The restoration approach of the raw material bead of a gestalt controlled also about the differential pressure between a raw material service tank and said cavity with control of the pressure in said cavity.

[0016]

[Function] As above, face filling up a raw material bead with this invention, and the pressure-control value in said cavity is gradually fluctuated during the restoration actuation. Since supply of a raw material bead is suspended on the occasion of the pressure fluctuation, compression air is supplied and a filled up raw material bead is pressed to one cavity side, and the part of the pressed raw material bead Since it is held at the configuration which ****ed in the configuration of the cavity concerned, as that to which the pack density of the raw material bead of the part with which it filled up previously before and after fluctuation of the pressure-control value, and the part with which it fills up later was changed It is certainly controllable, and if foaming of the obtained packing is carried out, a high density part will be fabricated by high intensity and a low consistency part will be fabricated by low strength.

[0017] Furthermore, with the gestalt which performs actuation of introducing heating steam and carrying out temporary immobilization of the filled up raw material bead before resumption of raw material bead supply, since the configuration of a filled up raw material bead is held by change of latter filling pressure, it becomes possible to realize the pack density difference by the restoration part more certainly. In this case, the circulation space

between the particles which the role of heating steam fix between raw material beads gently so that the restoration condition of the fill up raw material bead pressed by said compression air at one cavity side may not change with change of latter filling pressure, and can pass steam by the next heating fusing process be locate in the place which give the firmness which be hold, experiment beforehand, and should just define temperature, a pressure, etc.
[0018] Moreover, if the air for restoration is exhausted using the path between molds formed in fluctuating the pressure-control value in said cavity so that it may be outside open for free passage to the joint of metal mold located around the cavity of said metal mold, the difference in the pack density of a raw material bead is effectively realizable for the circumference part and central part of a cavity.
[0019]
[Embodiment of the Invention] Next, the 1st operation gestalt concerning the restoration approach of the raw material bead of this invention is explained with reference to drawing 1 - 6. Drawing 1 is the foaming metal mold equipment schematic drawing which simplified and displayed drawing 2 , a raw material bead is contained by the raw material service tank 4, and the air for restoration is supplied while the pressure is regulated by the tank pressurization regulator valve 42. And by adjusting displacement with the pressure regulating valves 24a, 25a, 34a, and 35a which lead to the chambers 2 and 3 of both sides, the internal pressure of a cavity 1 is constituted so that it can control from balance with the amount of sending of restoration air to a predetermined pressure. There is no place where others differ from the case of drawing 2 .
[0020] The place by which it is characterized [of this invention] maintains both the raw material service tank 4 and the cavity 1 in the pressurization condition, preparing differential pressure. A raw material bead Although it is the pressurization compression filling-up method with which it is filled up in a cavity 1 through the feeder 26 of a cavity 1 mostly arranged in the center and the pressure-control value in said ** cavity 1 is gradually fluctuated during the restoration actuation After suspending supply of a raw material bead on the occasion of the pressure fluctuation, supplying compression air and pressing a filled up raw material bead to one cavity side, supply of ** raw material bead is resumed. ** By the part in said cavity For example, it is in the point controlled by flat-surface partial 1b in the location near side-face partial 1a and the feeder 26 in the location distant from the feeder 26 to prepare a difference in the pack density of a raw material bead.
[0021] next, as a mode of fluctuation of the pressure-control value in a cavity 1 by drawing 4If the restoration approach of a gestalt of fluctuating the pressure-control value in said cavity from a high value gradually to a low value is explained Drawing 4 (A) is the first half phase of restoration actuation, displays tank ** of the raw material service tank 4 by chamber ** as a pressure in 3.0kg/cm2 and a cavity 1, and is this 2.8kg/cm2 It carries out and is the differential pressure 0.2kg/cm2 It maintains and is filled up with a raw material bead. In this case, the raw material bead sent in is not equally distributed from the beginning in a cavity, but side-face partial 1a with a location which is most separated from a feeder 26 is filled up first, and subsequently to the direction of a feeder 26 restoration progresses, finally it fills up to the place near restoration opening of a feeder 26, and restoration progresses even to flat-surface partial 1b in this way.
[0022] In this invention, in then, the phase which restoration of side-face partial 1a of a cavity satisfied mostly Suspend supply of a raw material bead, perform press actuation by compression air, and it goes into drawing 4 (B) which is subsequently the second half phase of restoration actuation. It is chamber ** which represents 2.0kg/cm2 and cavity ** for tank ** 1.8kg/cm2 If it is made to fall and future restoration is continued, even flat-surface partial 1b near restoration opening of a feeder 26 can be filled up, and restoration of the cavity 1 whole will be completed. 0.2kg/cm2 of in this case, that differential pressure It is maintaining.
[0023] When the density spread of the product obtained in this way shows an example, 33 g/l and flat-surface partial 1b become [side-face partial 1a] 25 g/l, and, for the compressive strength (reinforcement displayed with the stress at the time of 5% compression), side-face partial 1a is 250kg/cm2. It becomes and is 175kg/cm2 of flat-surface partial 1b. It receives and the remarkable difference can be established.
[0024] Here, with reference to drawing 5 R> 5, explanation is further added about the operation gestalt of the press actuation by the compression air performed when fluctuating control pressure. drawing in which drawing 5 (A) shows primary restoration actuation of the preceding paragraph -- it is -- pressure regulating valves 24a, 25a, 34a, and 35a -- where all are opened, as explained previously, a raw material bead is sent into a cavity 1 from a raw

material service tank.
[0025] And in the phase which restoration of side-face partial 1a of a cavity satisfied mostly, supply of a raw material bead is suspended and compression air is sent into a concave side chamber. For example, if pressure regulating valve 25a is closed and compression air is supplied from pressure regulating valve 24a, compression air is added to a convex side chamber from a concave side chamber, and a filled up raw material bead can be pressed from flat-surface partial 1b to side-face partial 1a in this case one side in a cavity 1. Since the pressure of the compression air in this case does not need to produce a volume change, it should just make a restoration raw material bead almost equivalent at the filling pressure of a raw material bead. Moreover, it is also suitable to replace with supplying from pressure regulating valve 24a, and to supply from a feeder 26.
[0026] Although supply of a raw material bead can be resumed where control pressure is fluctuated, and latter secondary restoration can be performed like drawing 5 (D) after this press actuation, since temporary fixed actuation shown in drawing 5 (C) before resumption of raw material bead supply is performed, with this operation gestalt, that point is explained below. If temporary fixed actuation of this drawing 5 (C) fluctuates control pressure after press actuation The filled up raw material bead with which it once filled up causes a volume change by the pressure fluctuation. What is necessary is to cope with the point that an expected pack density difference becomes is hard to be acquired, to replace for example, with compression air, to supply steam from pressure regulating valve 24a, and just to make it extract to pressure regulating valve 35a through a convex side chamber before resumption of raw material bead supply. In this case, pressure regulating valve 34a is good to close. The temperature from which the solidification condition of extent held without the configuration of a filled up raw material bead deforming by change of latter filling pressure, as explained previously is acquired is sufficient as the temperature of the steam of this temporary fixed actuation, and it is 1.0kg/cm2 as vapor pressure. Extent is enough. And if a raw material bead is solidified too much, namely, welding is advanced too much in this phase, since the welding reaction in a next heating fusing process will be checked, the balance of a foaming result of a product will collapse and a defect of shape etc. will be produced, it is not desirable.
[0027] Thus, in the restoration approach of fluctuating the pressure-control value in a cavity gradually, if the raw material bead which it was at the fluctuation time of a pressure-control value, and stopped temporarily and was filled up with supply of a raw material bead is turned to the lower one and pressed from the one where a filling pressure is higher, while being able to attain homogenization of the pressure of the part with which it filled up by that time, the boundary of change of pack density can be clarified more. Moreover, in the phase, if the aforementioned temporary fixed actuation is added, the effectiveness will become a positive thing.
[0028] In addition, in this invention, the pressure of the raw material service tank 4 may use the pressure sensor (not shown) which led to this tank, and the pressure of this cavity 1 may use each pressure sensor (not shown) which leads to the chambers 2 and 3 of the both sides of a cavity 1 that what is necessary is just to detect the pressure of a cavity 1 using the pressure sensor (not shown) which led to this cavity.
[0029] Next, other operation gestalten of the restoration approach of the raw material bead of this invention are explained with reference to drawing 6 . Drawing 6 shows the important section cross section of foaming molding-die equipment applicable to the restoration approach of the raw material bead of this invention, the convex type metal mold 31 and the concave metal mold 21 are fixed to frames 23 and 33, and opposite arrangement of it is carried out so that the cavity 1 by which the raw material bead for foaming is filled up with and fabricated may be formed. The feeder 26 (not shown) for raw material bead supply of the concave metal mold 21 is mostly attached in a central part. And to the rear-face side of these concaves and the convex metal mold 21 and 31 Points -- the concave side chamber 2 to which the utility of steam etc. is supplied, and the convex side chamber 3 are formed, and the up utility openings 24 and 34 for supplying the steam for heating etc. are formed in the upper part of each chamber 2 and 3 in this example -- are the same as that of the case of conventional drawing 2 .
[0030] And when the characteristic place of this metal mold equipment carries out mold closure of said convex type metal mold 31 and concave metal mold 21, the space of a cavity 1 is in the point currently formed so that it may be outside open for free passage from the external utility opening 27 through clearance 11x in which it is formed between the metal mold periphery sections 21a and 31a, and 11between mold interspace y of that outside. In addition,

although drawing 6 shows the upper half of metal mold equipment, the lower half which omitted the display shall be mostly constituted by the vertical symmetry.
[0031] It faces filling up a raw material bead with this operation gestalt using such metal mold equipment. Said clearance 11x which are the path between molds formed so that it may be outside open for free passage to the joint of metal mold, when a raw material bead is fed with the air for restoration from said feeder 26 and mold closure of the metal mold 21 and 31 of said pair is carried out, While exhausting the air for restoration through 11between mold interspace y, the displacement is controlled and the pressure-control value in said cavity is fluctuated. In this case, the pneumatic pressure for raw material bead restoration shall be controlled to keep the differential pressure beforehand defined between the pressures of a raw material service tank corresponding to the pressure in a cavity being the same as that of a previous operation gestalt.
[0032] With this operation gestalt, a raw material bead into the circumference part of the cavity located far away from a feeder 26 as restoration actuation of a raw material bead advances In the restoration sequence that concentrate certainly, fill up and even the central part of the cavity by which a feeder 26 is serially arranged from the circumference part is filled up becoming clearer, Since the pressure-control value in said cavity is made changed during the restoration actuation, the advantage which can set up effectively the difference in the pack density of the raw material bead of side-face partial 1a which is the circumference part of a cavity which is illustrated to drawing 3 , and flat-surface partial 1b equivalent to a central part is acquired.
[0033] In addition, what exists from the former can be used as said 11between mold interspace y, and it may be continuously formed over the perimeter of periphery point part 1a of a cavity 1 as clearance 11x, and may be formed intermittently. And the width method of the this clearance 11 cavity 1 side opening of x needs to set below to the outer diameter of the raw material bead with which it fills up.
[0034] Moreover, as shown in drawing 2, when the convex type metal mold 31 and the concave metal mold 21 are equipped with vent holes 22 and 32 with this operation gestalt, and when it can apply also in when [both] not having the vent hole and has vent holes 22 and 32, through these vent holes 22 and 32, exhaust air actuation of the air for restoration is suitably used together, and is performed from chambers 2 and 3, and it also becomes possible to adjust the restoration condition in a cavity.
[0035] Furthermore, it is also desirable to control about the magnitude of the differential pressure between the raw material service tank 4 and said cavity 1 itself at the same time it controls the pressure in a cavity by mode which was explained above as other operation gestalten of this invention. This differential pressure is driving force which conveys a raw material bead from a raw material service tank to a cavity, and by enlarging this value, since a bearer rate can be enlarged, it can send a raw material bead into a raw material bead to the part distant from the feeder, or a narrow part or the winding part. Moreover, if this value is set up small, more than the raw material bead set up beforehand, it can prevent filling up superfluously.
[0036] In addition, it becomes possible [also constituting pack density on a foaming object at the shape of two or more layers by it being also possible to fluctuate a value high from a conversely low value in this invention, although how to fluctuate the pressure-control value in a cavity to a value low from a high value in the above explanation has mainly been explained, and repeating fluctuation of a pressure-control value two or more times gradually]. Since the raw material bead of the part filled up with primary restoration will be pressurized in the case of secondary restoration when fluctuating the pressure-control value in a cavity from a low value to a high value especially, pressurization contraction is carried out in that case, It is easy to produce a volume change, and there is a situation that result expected pack density ** is hard to be obtained. Then, it is recommended as an approach with especially desirable performing said temporary fixed actuation to establish a comparatively big pack density difference in such a case.
[0037]
[Effect of the Invention] Since the restoration approach of the raw material bead of this invention is constituted as explained above, the pack density of the raw material bead of the request part in a cavity is changed, ** of acquiring the foaming object which therefore set up the difference on the strength partially becomes possible, and it can respond to the various needs to a foaming object. Moreover, actuation of setting like the same packer and changing a consistency can be performed, and since it is not necessary to prepare the raw material

bead with which expansion ratio differs, there is outstanding effectiveness that shortening of a process cycle, the increase in efficiency of use energy, etc. can be attained. Therefore, as the restoration approach of a raw material bead that this invention canceled the conventional trouble, a so-called size has the industrial value extremely.

TECHNICAL FIELD

[Field of the Invention] This invention relates to amelioration of the restoration approach of the raw material bead in the foaming approach for manufacturing the adiathermic container made of foaming resin, such as polystyrene, the mold material for construction, or heat insulation under floor ground material.

PRIOR ART

[Description of the Prior Art] The outline of the foaming approach used as the background of this invention is explained. As shown in the cross-section schematic drawing of drawing 2 , the convex type metal mold 31 and the concave metal mold 21 are fixed to frames 33 and 23, arrangement of the metal mold equipment used for this conventional foaming is mutually close, and opposite arrangement is carried out so that a foaming product may form the cavity 1 by which restoration shaping is carried out. and although the concave metal mold 21 is usually being fixed, the convex type metal mold 31 is arranged movable with the closing motion driving gear (not shown) which can carry out retreat migration rightward drawing 2 -- horizontally, can take out the fabricated foam from the condition which formed the cavity 1 in the concave metal mold 21 like drawing 2 , and can carry out advance migration leftward drawing 2 -- since it is shaping actuation. And many vent holes 22 and 32 are ****(ed) by this metal mold 21 and 31 over that whole surface so that the utility of the steam for heating etc. can be passed.

[0003] Moreover, the concave side chamber 2 to which the utility of steam etc. is supplied, and the convex side chamber 3 are formed in the rear-face side of these concaves and the convex metal mold 21 and 31. In addition, in this example, the up utility openings 24 and 34 for supplying the steam for heating etc. are formed in the upper part of each chamber 2 and 3, the lower utility openings 25 and 35 are formed in the lower part, and it connects with a reduced pressure pump or drain piping (neither is illustrated).

[0004] In addition, in fact, the vent holes 22 and 32 of a large number ****(ed) by metal mold 21 and 31 insert in the front face of metal mold 21 and 31 the core vent made from an aluminium alloy which consists of a barrel which has a lid with an outer diameter of 7-12mm which ****(ed) 10-20 vent holes of 0.5mmphi extent in the core-vent mounting hole which carried out hole dawn arrangement in the pitch of 20-30mm, and are prepared.

[0005] Like the packer of the raw material bead which fills up with the foaming approach using such metal mold equipment for foaming the raw material bead which carried out mold closure of the (1) metal mold, formed the cavity 1, and carried out [polystyrene] pre-expansion into this cavity 1. (2) The heating process which heats this raw material bead with the steam for heating, and carries out melting foaming. (3) After that, after the cooling process which carries out cooling solidification of the foam, and (4) cooling, carry out die opening and it consists of a procedure of the mold release process taken out from metal mold equipment as a foaming object of a predetermined configuration.

[0006] Here, the packer of (1) raw-material bead degree is described further. Although it is the process fed and filled up with the raw material bead which pressurized the external raw material service tank 4 with compression air, and held it in the interior in a cavity 1 through a feeder 26 through a delivery pipe 41 and there are the cracking filling-up method, the pressurization filling-up method, the pressurization compression filling-up method, etc. in it, the compression air into which all were sent with a raw material bead is extracted by both-sides chambers 2 and 3 through vent holes 22 and 32 from a cavity 1, and is discharged outside.

[0007] And for example, while conveying in a cavity 1 by the differential pressure by the pressurization compression filling-up method, pressurizing a raw material bead, forming both the raw material service tank 4 and the cavity 1 for differential pressure, it is the approach with which it is filled up under a pressure predetermined [more than atmospheric pressure]. In this case, the pressure in a cavity is preparing and controlling the pressure control valve etc. in the process which it is extracted by the both-sides chambers 2 and 3 through vent

holes 22 and 32 from a cavity 1, and is discharged outside.
[0008] According to this restoration approach, since filling pressure can be set up highly, a charging efficiency can also improve, and the advantage which can prevent the variation in pack density is acquired. That is, since compressibility becomes comparatively homogeneous by side-face partial 1a of a cavity 1, and flat-surface partial 1b and there is no unevenness in the restoration degree of the side-face partial 1a and flat-surface partial 1b in drawing 3 which shows packing formed from a cavity 1, it will be hard to produce foaming unevenness also at the time of pressurization foaming, and a homogeneous foaming object will be acquired. (In drawing 2 and drawing 3 , the common sign is given to the side-face part and the flat-surface part.)
[0009] Thus, it was what is considered so that the variation in quality like foaming unevenness as much as possible may not arise in mold goods in the conventional foaming. However, in a box-like container as shown in drawing 3 from the convenience on use, there is a case where he wants to fabricate side-face partial 1a which becomes a part for the wall to closing in from flat-surface partial 1b which is a bottom part, and to give high intensity. By the above mentioned usual pressurization compression filling-up method, there was a problem that it could not respond to such a request.
[0010] Moreover, a difference is prepared in foaming extent by the part of a foaming object, and there is the Normal cracking filling-up method as the restoration approach of giving change to completion reinforcement. Without closing concave and the convex metal mold 21 and 31 completely on the occasion of restoration actuation, a raw material bead is sent in from the raw material service tank 4 by the injection air sent into a feeder 26 in the condition which left a certain amount of clearance temporarily to those metal mold periphery sections 21a and 31a, i.e., the condition that established cracking and that cracking clearance was wide opened by atmospheric air, and it fills up with this cracking filling-up method in the atmospheric pressure condition.
[0011] By such cracking filling-up method, since the raw material bead of flat-surface partial 1b of a cavity 1 is mechanically compressed too much by the cracking clearance by eye mold closure after restoration, as compared with side-face partial 1a, pack density serves as size. Consequently, high intensity is made to fabricate flat-surface partial 1b as compared with side-face partial 1a. Thus, although only flat-surface partial 1b could be fabricated by the cracking filling-up method to high intensity, when side-face partial 1a was not able to be fabricated to high intensity, and the part from which thickness differs was in flat-surface partial 1b, there was a problem that homogeneous pack density was not obtained all over flat-surface partial 1b.
[0012] As the other approaches, two sorts of raw material beads with which expansion ratio differs are prepared, and there is the approach of using properly in the first half and the second half of restoration actuation. According to this, expansion ratio can be changed by the part of a restoration Plastic solid, and the foaming object with which structure reinforcement differs as a result can be acquired. However, by this approach, there was an inconvenient point that expansion ratio naturally differed beforehand and that how many kinds of those raw material beads must be prepared.

EFFECT OF THE INVENTION

[Effect of the Invention] Since the restoration approach of the raw material bead of this invention is constituted as explained above, the pack density of the raw material bead of the request part in a cavity is changed, ** of acquiring the foaming object which therefore set up the difference on the strength partially becomes possible, and it can respond to the various needs to a foaming object. Moreover, actuation of setting like the same packer and changing a consistency can be performed, and since it is not necessary to prepare the raw material bead with which expansion ratio differs, there is outstanding effectiveness that shortening of a process cycle, the increase in efficiency of use energy, etc. can be attained. Therefore, as the restoration approach of a raw material bead that this invention canceled the conventional trouble, a so-called size has the industrial value extremely.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] This invention is proposed that such a problem should be solved, the pack density of the raw material bead of the request part of the foaming

object in a cavity is changed, and the restoration approach of the raw material bead in the foaming approach that the foaming object which therefore set up the difference on the strength partially can be acquired is offered.

MEANS

[Means for Solving the Problem] The restoration approach of the raw material bead of this invention which solved the above-mentioned problem In the foaming approach released from mold and taken out after filling up with a raw material bead the cavity for foaming surrounded and formed in the rear-face side with the metal mold of the pair which arranged the chamber, heating it, making it foam and cooling a foaming object, nothing, and it While facing preparing differential pressure between a raw material service tank and said cavity, and being filled up with a raw material bead and fluctuating the pressure-control value in said cavity gradually during the restoration actuation After suspending supply of a raw material bead on the occasion of the pressure fluctuation, supplying compression air and pressing a filled up raw material bead to one cavity side, supply of a raw material bead is resumed. It is characterized by controlling to prepare a difference in the pack density of a raw material bead by the part in said cavity.
[0015] Moreover, this invention can be preferably materialized in the following gestalt.
(1) The restoration approach of the raw material bead of a gestalt of performing actuation of introducing heating steam and carrying out temporary immobilization of the filled up raw material bead before resumption of raw material bead supply press of the filled up raw material bead by said compression air, or after pressing.
(2) The restoration approach of the raw material bead of a gestalt of fluctuating the pressure-control value in said cavity while exhausting the air for restoration using the path between molds formed so that it may be outside open for free passage to the joint of metal mold located around a cavity, when mold closure of the metal mold of said pair is carried out.
(3) The restoration approach of the raw material bead of a gestalt controlled also about the differential pressure between a raw material service tank and said cavity with control of the pressure in said cavity.

OPERATION

[Function] As above, face filling up a raw material bead with this invention, and the pressure-control value in said cavity is gradually fluctuated during the restoration actuation. Since supply of a raw material bead is suspended on the occasion of the pressure fluctuation, compression air is supplied and a filled up raw material bead is pressed to one cavity side, and the part of the pressed raw material bead Since it is held at the configuration which ****ed in the configuration of the cavity concerned, as that to which the pack density of the raw material bead of the part with which it filled up previously before and after fluctuation of the pressure-control value, and the part with which it fills up later was changed It is certainly controllable, and if foaming of the obtained packing is carried out, a high density part will be fabricated by high intensity and a low consistency part will be fabricated by low strength.
[0017] Furthermore, with the gestalt which performs actuation of introducing heating steam and carrying out temporary immobilization of the filled up raw material bead before resumption of raw material bead supply, since the configuration of a filled up raw material bead is held by change of latter filling pressure, it becomes possible to realize the pack density difference by the restoration part more certainly. In this case, the circulation space between the particles which the role of heating steam fix between raw material beads gently so that the restoration condition of the fill up raw material bead pressed by said compression air at one cavity side may not change with change of latter filling pressure, and can pass steam by the next heating fusing process be locate in the place which give the firmness which be hold, experiment beforehand, and should just define temperature, a pressure, etc.
[0018] Moreover, if the air for restoration is exhausted using the path between molds formed in fluctuating the pressure-control value in said cavity so that it may be outside open for free passage to the joint of metal mold located around the cavity of said metal mold, the difference in the pack density of a raw material bead is effectively realizable for the circumference part and central part of a cavity.
[0019]
[Embodiment of the Invention] Next, the 1st operation gestalt concerning the restoration

approach of the raw material bead of this invention is explained with reference to drawing 1 - 6. Drawing 1 is the foaming metal mold equipment schematic drawing which simplified and displayed drawing 2 , a raw material bead is contained by the raw material service tank 4, and the air for restoration is supplied while the pressure is regulated by the tank pressurization regulator valve 42. And by adjusting displacement with the pressure regulating valves 24a, 25a, 34a, and 35a which lead to the chambers 2 and 3 of both sides, the internal pressure of a cavity 1 is constituted so that it can control from balance with the amount of sending of restoration air to a predetermined pressure. There is no place where others differ from the case of drawing 2 .

[0020] The place by which it is characterized [of this invention] maintains both the raw material service tank 4 and the cavity 1 in the pressurization condition, preparing differential pressure. A raw material bead Although it is the pressurization compression filling-up method with which it is filled up in a cavity 1 through the feeder 26 of a cavity 1 mostly arranged in the center and the pressure-control value in said ** cavity 1 is gradually fluctuated during the restoration actuation After suspending supply of a raw material bead on the occasion of the pressure fluctuation, supplying compression air and pressing a filled up raw material bead to one cavity side, supply of ** raw material bead is resumed. ** By the part in said cavity For example, it is In the point controlled by flat-surface partial 1b in the location near side-face partial 1a and the feeder 26 in the location distant from the feeder 26 to prepare a difference in the pack density of a raw material bead.

[0021] next, as a mode of fluctuation of the pressure-control value in a cavity 1 by drawing 4If the restoration approach of a gestalt of fluctuating the pressure-control value in said cavity from a high value gradually to a low value is explained Drawing 4 (A) is the first half phase of restoration actuation, displays tank ** of the raw material service tank 4 by chamber ** as a pressure in 3.0kg/cm2 and a cavity 1, and is this 2.8kg/cm2 It carries out and is the differential pressure 0.2kg/cm2 It maintains and is filled up with a raw material bead. In this case, the raw material bead sent in is not equally distributed from the beginning in a cavity, but side-face partial 1a with a location which is most separated from a feeder 26 is filled up first, and subsequently to the direction of a feeder 26 restoration progresses, finally it fills up to the place near restoration opening of a feeder 26, and restoration progresses even to flat-surface partial 1b in this way.

[0022] In this invention, in then, the phase which restoration of side-face partial 1a of a cavity satisfied mostly Suspend supply of a raw material bead, perform press actuation by compression air, and it goes into drawing 4 (B) which is subsequently the second half phase of restoration actuation. It is chamber ** which represents 2.0kg/cm2 and cavity ** for tank ** 1.8kg/cm2 If it is made to fall and future restoration is continued, even flat-surface partial 1b near restoration opening of a feeder 26 can be filled up, and restoration of the cavity 1 whole will be completed. 0.2kg/cm2 of in this case, that differential pressure It is maintaining.

[0023] When the density spread of the product obtained in this way shows an example, 33 g/l and flat-surface partial 1b become [side-face partial 1a] 25 g/l, and, for the compressive strength (reinforcement displayed with the stress at the time of 5% compression), side-face partial 1a is 250kg/cm2. It becomes and is 175kg/cm2 of flat-surface partial 1b. It receives and the remarkable difference can be established.

[0024] Here, with reference to drawing 5 R> 5, explanation is further added about the operation gestalt of the press actuation by the compression air performed when fluctuating control pressure. drawing in which drawing 5 (A) shows primary restoration actuation of the preceding paragraph – it is – pressure regulating valves 24a, 25a, 34a, and 35a – where all are opened, as explained previously, a raw material bead is sent into a cavity 1 from a raw material service tank.

[0025] And in the phase which restoration of side-face partial 1a of a cavity satisfied mostly, supply of a raw material bead is suspended and compression air is sent into a concave side chamber. For example, if pressure regulating valve 25a is closed and compression air is supplied from pressure regulating valve 24a, compression air is added to a convex side chamber from a concave side chamber, and a filled up raw material bead can be pressed from flat-surface partial 1b to side-face partial 1a in this case one side in a cavity 1. Since the pressure of the compression air in this case does not need to produce a volume change, it should just make a restoration raw material bead almost equivalent at the filling pressure of a raw material bead. Moreover, it is also suitable to replace with supplying from pressure regulating valve 24a, and to supply from a feeder 26.

[0026] Although supply of a raw material bead can be resumed where control pressure is

fluctuated, and latter secondary restoration can be performed like drawing 5 (D) after this press actuation, since temporary fixed actuation shown in drawing 5 (C) before resumption of raw material bead supply is performed, with this operation gestalt, that point is explained below. If temporary fixed actuation of this drawing 5 (C) fluctuates control pressure after press actuation The filled up raw material bead with which it once filled up causes a volume change by the pressure fluctuation. What is necessary is to cope with the point that an expected pack density difference becomes is hard to be acquired, to replace for example, with compression air, to supply steam from pressure regulating valve 24a, and just to make it extract to pressure regulating valve 35a through a convex side chamber before resumption of raw material bead supply. In this case, pressure regulating valve 34a is good to close. The temperature from which the solidification condition of extent held without the configuration of a filled up raw material bead deforming by change of latter filling pressure, as explained previously is acquired is sufficient as the temperature of the steam of this temporary fixed actuation, and it is 1.0kg/cm2 as vapor pressure. Extent is enough. And if a raw material bead is solidified too much, namely, welding is advanced too much in this phase, since the welding reaction in a next heating fusing process will be checked, the balance of a foaming result of a product will collapse and a defect of shape etc. will be produced, it is not desirable.

[0027] Thus, in the restoration approach of fluctuating the pressure-control value in a cavity gradually, if the raw material bead which it was at the fluctuation time of a pressure-control value, and stopped temporarily and was filled up with supply of a raw material bead is turned to the lower one and pressed from the one where a filling pressure is higher, while being able to attain homogenization of the pressure of the part with which it filled up by that time, the boundary of change of pack density can be clarified more. Moreover, in the phase, if the aforementioned temporary fixed actuation is added, the effectiveness will become a positive thing.

[0028] In addition, in this invention, the pressure of the raw material service tank 4 may use the pressure sensor (not shown) which led to this tank, and the pressure of this cavity 1 may use each pressure sensor (not shown) which leads to the chambers 2 and 3 of the both sides of a cavity 1 that what is necessary is just to detect the pressure of a cavity 1 using the pressure sensor (not shown) which led to this cavity.

[0029] Next, other operation gestalten of the restoration approach of the raw material bead of this invention are explained with reference to drawing 6 . Drawing 6 shows the important section cross section of foaming molding-die equipment applicable to the restoration approach of the raw material bead of this invention, the convex type metal mold 31 and the concave metal mold 21 are fixed to frames 23 and 33, and opposite arrangement of it is carried out so that the cavity 1 by which the raw material bead for foaming is filled up with and fabricated may be formed. The feeder 26 (not shown) for raw material bead supply of the concave metal mold 21 is mostly attached in a central part. And to the rear-face side of these concaves and the convex metal mold 21 and 31 Points -- the concave side chamber 2 to which the utility of steam etc. is supplied, and the convex side chamber 3 are formed, and the up utility openings 24 and 34 for supplying the steam for heating etc. are formed in the upper part of each chamber 2 and 3 in this example -- are the same as that of the case of conventional drawing 2 .

[0030] And when the characteristic place of this metal mold equipment carries out mold closure of said convex type metal mold 31 and concave metal mold 21, the space of a cavity 1 is in the point currently formed so that it may be outside open for free passage from the external utility opening 27 through clearance 11x in which it is formed between the metal mold periphery sections 21a and 31a, and 11between mold interspace y of that outside. In addition, although drawing 6 shows the upper half of metal mold equipment, the lower half which omitted the display shall be mostly constituted by the vertical symmetry.

[0031] It faces filling up a raw material bead with this operation gestalt using such metal mold equipment. Said clearance 11x which are the path between molds formed so that it may be outside open for free passage to the joint of metal mold, when a raw material bead is fed with the air for restoration from said feeder 26 and mold closure of the metal mold 21 and 31 of said pair is carried out, While exhausting the air for restoration through 11between mold interspace y, the displacement is controlled and the pressure-control value in said cavity is fluctuated. In this case, the pneumatic pressure for raw material bead restoration shall be controlled to keep the differential pressure beforehand defined between the pressures of a raw material service tank corresponding to the pressure in a cavity being the same as that of a previous operation gestalt.